SCIENCE

FRIDAY, MARCH 23, 1888.

COL. CARROLL D. WRIGHT, chief of the Bureau of Labor Statistics, is now engaged in the preparation for the work of the coming year. The subject he proposes to have investigated is the actual earnings of the railroad employees of the country. To ascertain this, he does not propose to be content with averages, but will ascertain from the pay-rolls of the companies just what each man in each grade of employment receives during the year. From this he will be able to determine what the actual earnings in the several departments are. The defect of all statistics of this kind, except those gathered by Colonel Wright in Massachusetts, is that they have dealt chiefly with averages, which really give no idea whatever of what the income of the working-people is. Dividing the total amount of wages paid in a month, or a year, by the total number of employees, produces a result that is of little or no value in economics. As the proportion of high or low priced employees is increased or diminished, the average will be raised or lowered, though the actual earnings of an individual in any particular department may not be changed. The series of reports now issuing from Colonel Wright's office are of more scientific value than any statistics heretofore published by the government, excepting the census reports. They are collected in accordance with a carefully devised and skilfully worked-out plan prepared by Colonel Wright himself. The agents employed are experienced and trained, and the results are calculated to show the actual facts. In the discussion of these facts, Colonel Wright has no preconceived theories to establish, no partisan purpose to serve. The one object is to find the truth, and, that discovered, the purpose of Colonel Wright's work is accomplished.

THE UNITED STATES DEPARTMENT OF AGRICULTURE has issued the third part of the report on foods and food adulterants. It treats of fermented alcoholic beverages, malt liquors, wine, and cider, and represents a vast amount of work by C. A. Crampton, the chemist, and his assistants. The opening sentences of this report are calculated to excite a good deal of thought and reflection. They are as follows: "The production of malt liquors in this country as an industry is second only in importance to the production of breadstuffs. Their consumption is steadily on the increase, as is also the amount consumed in proportion to other kinds of alcoholic beverages." These facts are well illustrated by tables, from which a few figures will be selected. In 1840 there were consumed in the United States, 23,310,843 gallons of malt liquors. From that time until 1886 the amount of annual consumption increased, until during that year it had reached 642,967,720 gallons. In 1840 the consumption *per capita* of the population was 1.36 gallons, while in 1886 it was 11.18 gallons. During the same period the *per capita* consumption of distilled spirits has decreased from 2.52 to 1.24, or, in other words, the malt liquors have been driving out the distilled at the rate of about .05 of a gallon *per capita* each year, and supplanting them at the rate of about .38 o a gallon *per capita*. It is estimated that the amount expended for beer per annum is $304,852,683, placing the cost to the consumer at 50 cents a gallon. The annual cost to the consumer, of all liquors consumed, is placed at $700,000,000. And yet the statement is made that the United States, although holding her own in the quantity of distilled liquors consumed, is still far behind the other great nations in the consumption of the milder alcoholic liquors; and the statistics certainly bear out this statement. Thus in the United States there were consumed 11.18 gallons of malt liquors *per capita* in 1886: in the United Kingdom there were consumed 32.79; and in Germany, 23.78 gallons in the same period. In speaking of the enormous consumption of beer in the United States, Mr. Crampton says that there is no beverage that compares with it in the amount consumed by the people, except water, and possibly milk; and that but little supervision has been exercised over its manufacture and sale, except the rigorous enforcement by the government of its demands for a share in the profits. The processes of brewing, malting, fermenting, clarifying, and preserving are fully described in the report, and analyses are given of all the beers which are drunk in the United States. From these it would appear that the average amount of alcohol, by weight, is 4.63 per cent. Of thirty-two samples analyzed by the department, salicylic acid was found in seven. These were all bottled beers, one of them being imported. None was found in any of the draught beers. Of the nineteen samples of American bottled beers analyzed, six contained this acid. These six included the product of some of the largest breweries in the country, — beers that are used to a very large extent all over the United States. Whether the acid is added in the breweries where the beer is made, or by the local bottlers, could not be determined. The acid is added to prevent fermentation, and as has been shown by Dr. Bartley, formerly chief chemist to the Brooklyn Board of Health, the amount which beers contain is sufficient to be injurious to health. Of seventy samples of wine examined by Mr. Crampton, including champagne, burgundy, claret, sherry, sauterne, and other wines in common use, eighteen contained salicylic acid, and thirteen sulphurous acid, which had been added as such or in the form of a sulphite. One sample in forty contained one aniline dye-stuff, probably fuchsine: this was a California claret. In the analyses which were made of cider, some were found to contain as much as 8.09 per cent of alcohol by weight, the average being 5.17 per cent. These were all well-fermented ciders, and all bottled but one. In the 'sweet' or incompletely fermented ciders, the percentage of alcohol averaged 1.40, the lowest being 0.20, and the highest 3.46. No salicylic acid was detected in any of the ciders examined, and but one was adulterated. This was a bottled 'sparkling cider,' handsomely put up in neatly capped bottles, and of a clear, bright color. In it were found both bicarbonate of soda and a sulphite. This report is in its entirety a most valuable one, replete with information which is interesting to the general reader, as well as instructive to the scientist.

THE STATE BOARD OF HEALTH of Illinois has been the pioneer in the movement to restrict the practice of medicine to those who are qualified. This policy has been based on a law passed by the Legislature of that State, giving to the board the sole power to grant licenses to physicians, without which the practice of medicine is illegal, and the offenders subject to a severe penalty. The law grants to the board the additional power of revoking licenses which have previously granted. It has been hitherto supposed that there was no restriction on this power of revocation, but a recent decision of the courts in that State would seem to indicate that this power cannot be exercised without limitations. An Illinois physician having advertised in the newspapers, the State board revoked his license. The court maintains that the right to advertise one's business is a right to which every citizen is entitled, and that to deprive him of this right is unconstitutional, and that members of

the medical profession cannot be discriminated against, any more than the members of any other profession or trade. This decision will, we presume, be appealed from, and the final result will be watched with interest.

WASHINGTON SCIENTIFIC NEWS.

Zuñi Mythology and Religion: a Valuable Contribution to Anthropology. — The Life-History of Tænia Pectinata: Does the Presence of this Parasite explain the Winter-Killing of Sheep? — The Function of the Bone in Anchoring Implanted Teeth: Result of Dr. W. M. Gray's Investigations. — Some Recent Discussions of Target-Shooting. — Obscure and Conflicting Phenomena of the Drift North of Lake Ontario. — Sources of Error in the Determination of Atomic Weights. — The Pristine Homes of the Indian Tribes of this Continent.

Zuñi Religion.

THE annual meeting of The Women's Anthropological Society, held March 8, was a memorable one in the history of that organization. The paper of the evening was read by Mrs. T. E. Stevenson, the president of the society, on the Zuñi religion; and the most accomplished anthropologists in Washington, who were present as guests, pronounced it, in the conversational discussion which followed, to be the best presentation of a savage religion yet written.

Introducing her subject, Mrs. Stevenson said, that, according to Zuñi tradition, all Indians entered this world in the far North-west, having ascended through three lower worlds before their advent here. "The Zuñi came to this world by the command of the Sun," she said, "who sent his sons, Ah-ai-u-ta and Ma-a-se-we (two little war-gods) as bearers of his message, and to guide them to his presence. They ascended from the lower world through a huge reed. Po-shai-yan-tka, the high priest of the Zuñi, followed immediately after the gods. The other priests came next in succession; then the eight original medicine orders and all carnivorous animals. Upon reaching this world, the Zuñi for the first time beheld the light of day, and they bowed to the earth, and hid their faces in fear. It was discovered by the light of day that the Zuñi possessed long, hairless tails, which Ah-ai-u-ta amputated with his stone knife. According to the word of the present priest of the warriors, the people also had long ears, reaching to the ground, which they rolled and tied up by day, while at night they served as a bed and covering.

"The Zuñi do not believe they existed in interior worlds as animal species, other than Zuñi themselves, with their great ears and hairless tails. The other animals could communicate with them as between man and man. These animals were superior to the Zuñi, and were then, as now, mediators between them and the gods. They held all medicine secrets, which they revealed to the Zuñi only after coming to this world."

Mrs. Stevenson then enumerated the medicine orders in the succession in which they reached this world. "These orders," she said, "also the priests of the cardinal points and others, brought many precious articles from the lower world, which they carried on their backs in sacred blankets, the E-to-ne being the most valued fetich they brought. The E-to-ne is a miniature sarcophagus, in which two frogs and two tadpoles, the first offspring of the frog, seeds of cotton, and other vegetation, are incased. On the top of this stone case are eight te-lik-yi-na-we, or plume-sticks, laid lengthwise, about an inch of each one projecting over the edge of the box. Between the eight plume-sticks is an ear of corn representing the mother-corn, or fecundity. The case is wrapped with a piece of ancient cotton cloth, and around the whole are strings of turquoise and ko-ha-qua beads. In some instances the E-to-na is so heavily wrapped with beads that nothing else is to be seen except the projecting ends of the plume-sticks. On the end of each stick a breast-feather of the eagle is attached, pendent, by a cotton cord of native manufacture. The Order of Rain has, in place of the E-to-na, a female stone image, eight inches high, — the Wi-ha-tsan-na Ah-win-tsi-ta, the great mother of all infants.

"The Order of the Ha-lo-o-que has, instead of the E-to-na, a stone knife, the destroyer of all enemies. This knife is about twelve inches in length."

After enumerating the other medicine orders, Mrs. Stevenson gave in very brief outline the story in connection with the forming of the Order of the Hunters, as follows: —

"A strange people were discovered by certain ancestral gods. Three of the gods were captured, and a battle was the result. The lines of the enemy were protected by the tCha-que-na, the keeper of all game: she passes to and fro, shaking a rattle. Great efforts were made to kill the woman, and, though many arrows pierced her breast, she still continued to walk, and shake the rattle. The war-god, Ah-ai-u-ta, finally declared she was carrying her heart in the rattle: he aimed his arrow at the rattle, struck it, and the tCha-que-na fell dead. It was now an easy matter to rout the enemy and enter their home, which they did, opening the wall that enclosed all game, permitting it to go where it would, and thus the game spread over the earth."

The stories of the origin of the other orders were also given briefly, and then Mrs. Stevenson continued the Zuñi account of their establishment in their present home, as follows: —

"Po-shai-yan-tka did not remain long with his people after reaching this world: he travelled with them for a time southward, then, separating from the main party, he, accompanied by the orders of the Ne-we-e-que and Shu-ma-a-que, his wife, I-ya-ti-ku (who was very beautiful and good), and all the animals that came to this world with him, travelled far to the east, then south. A long time was consumed in his journeying, and he built many villages on the way, and, finally reaching the Rio Grande, built houses in the cliffs. These the Zuñi locate as the line of Cavate houses west of the pueblos of San Juan and Santa Clara, in New Mexico. They extended some thirty miles along the right bank of the Rio Grande. These ruins are known to the Zuñi as the singing house of Po-shai-yan-tka; for it was here the animals gave to Po-shai-yan-tka their songs and medicine secrets, he in turn instructing the people. Po-shai-yan-tka, before separating from his people, gave to them the priest Yan-a-o-loo-a to be to them a father in his absence, he promising to return to them, wherever they might be. Old Zuñi priests say they are weary with watching for his return. The name of this departed priest is so reverently held by these people, that it is seldom mentioned excepting in prayer, and each day prayers of supplication are made for his return. This priest is believed by the Zuñi to be the Montezuma known in Mexican history.

"The Zuñi, led by the war-gods, travelled many years to the south, then east, stopping often to build villages, where they for a time lived. Besides the thirteen medicine orders of Zuñi, there is an order to which I referred in a paper previously presented before this society, — the Order of the Kok-ko, the mythological period. It will be remembered that I mentioned in that paper the transformation of a boy and girl upon a mountain-top, who had been sent in advance to look for a place on which to build a village. After the transformation, the youth descended to the plains below, swept his foot through the sands, and created a river and a lake, and in the lake a group of houses, the centre one being the great assembly-house for the Kok-ko. The first three gentes to cross this river were the Sand-hill Crane, Bear, and Corn. The women were afraid, and dropped their children into the water; and the little ones were transformed into ducks, snakes, lizards, etc., and afterwards changed into the Kok-ko, becoming ancestral gods. The three gentes who lost their children composed the Order of Wood, and this order, after becoming childless, determined to leave their party, and go in search of their beloved priest Po-shai-yan-tka. From this point the Zuñi advanced eastward some sixty miles, locating upon the present site of Zuñi. The present village, however, was built upon the old village after their return from a mesa near by, upon which they lived for a long period, and where extensive ruins are now to be seen.

"The Wood Order, after separating from the Zuñi, took first a northerly course, then easterly, reaching the Rio Grande, and passing down this river till they at last found the home of the much-longed-for father. During this journey they built four villages about equal distance from one another, remaining at each village four years, which words, however, according to Zuñi tradition, refer to periods of time. This order found the home of their father, Po-shai-yan-tka, guarded by formidable sentinels. The first was a mountain-lion decorated with two eagle-plumes, — one attached to

the back of his neck, and one on top of his head. As the order approached, the mountain-lion arose and advanced, angry and growling; but upon the presentation of the plume-sticks, with which the order was provided, and their sprinkling upon him sacred meal, he became gracious, and invited them to enter into the house of his chief. Five other animals, sentinels, had to be propitiated in like manner — the bear, badger, white wolf, eagle, and mole — ere the Order of Wood reached the presence of the great priest. They were welcomed by Po-shai-yan-tka, who told them they must remain with him for a time, and be taught by him. Many years had elapsed since he had separated from his people in the far north-west, and there were many villages surrounding the home of the priest. Po-shai-yan-tka, desiring that others of the Shiwina or Zuñi should also be taught, commanded their presence through his messenger, the Lightning. Upon the arrival of the orders, Po-shai-yan-tka commanded all to gather into groups and listen attentively, for he was about to instruct them in all the medicine songs and dances, the songs to be sung in winter, and the songs for summer. The winter songs must not be sung when the sun was hot, nor must the summer songs be sung in winter time. Each group was provided with a pottery drum, vase-shaped, the opening covered with hide. But one drum-stick, the Nit-tsi-tKi, was used to each drum. This drum-stick was brought from the interior worlds by Po-shai-yan-tka, and, like all articles that came to this world with the Zuñi, is of special value and significance.

"The leader of each group beat upon his drum. All the Shiwina or Zuñi paid special attention, and heard the songs straight, and so remembered them. But the people of the many villages did not hear straight: therefore the songs sung by the Zuñi at the present time are the only authentic songs of Po-shai-yan-tka. He also gave to them all altars of wood and sand, instructing the people how to make them. The medicine and songs came from other animals, but knowledge of the altars sprang directly from Po-shai-yan-tka. In the heart of Po-shai-yan-tka the knowledge of all earthly things originated. The altars were strictly guarded by the animals during the season of instruction, and the people were commanded to have the altars they made guarded in the same manner, the animals assuming relative positions. And since that time these altars have been guarded by stone animals which were once living, but were converted into stone by the great fire that swept over the earth. Trees were likewise converted into stone. The size of the image depends upon the length of time the animal was subjected to the fire: the longer it burned, the smaller it became. Thus these people account for the diminutive size of their animal fetiches. The Zuñi returned to their home, bearing with them the promise of Po-shai-yan-tka's return. Po-shai-yan-tka then commanded the lion to make his home in the north for all future time, as the protector of the north. The bear he sent as protector of the west, the badger to the south, the white wolf to the east, the eagle to the heavens, and the mole to the earth. All other animals he scattered over the face of the earth."

The lack of space forbids giving in this abstract Mrs. Stevenson's exceedingly interesting description of the ceremonials of the different orders. Gaining the entire confidence of the Zuñi, she adopted their dress, painted her face, and witnessed all their secret rites. Speaking of the necromancy or magical arts of the Order of the Ooh-hoo-hoo-ooh-que, she says, —

"One of their tricks is for two persons to draw a rope to and fro across the body of another until it appears on the opposite side. Another is to pass two breast-feathers of the eagle through the flame of a lamp, bringing out two charred bits, and, after manipulating for a time, pressing the bits to their nude breasts, reproducing the feathers in all their original beauty. Mush is made and rolled into small balls, which are passed to the members of the order to eat. The *prestidigitateur* then dips two eagle-plumes in medicine-water, and sprinkled it upward, calling upon the eagle-god of the heavens to convert the mush into stone. The balls are again passed, when they are found to be as hard as stone. Again the plumes are dipped into the medicine-water, and sprinkled to the fire, with the request that the goddess reconvert the stones into mush. Hot water is made cold by the same process, with the feathers, and again heated by calling upon the goddess of fire."

The Wood Order are very clever at legerdemain. Mrs. Stevenson says, "When I first witnessed the swallowing of the knife, I was inclined to think it a ready trick. A youth approached the altar, and dipped the ends of two eagle-plumes into medicine-water, and, after touching his breast with the plumes, he danced wildly before the altar; then he reached behind the altar for his knife, which he held upward while he danced, at times distorting his body, and throwing himself almost prostrate; then he would, with a graceful gesture, turn and suddenly fall on the left knee, immediately in front of the gayly decorated altar, with his back to the altar, he facing the east, and, throwing his head back, run the sword down his throat, leaving nothing but the handle to be seen. This feat was repeated three times, when the eagle-plumes were again dipped into the medicine-water, and touched to the mouth. To convince myself the knife was genuinely put down the throat, after long persuasion, I induced a youth belonging to the order to swallow the knife. This was done in secrecy. The youth removed his head-kerchief, and took off his leather belt and pouch, and, after repeating a long prayer, he placed the knife in his mouth, running it down the throat to the handle. I am told death is sometimes the result, but this is always attributed to a bad heart."

In closing, Mrs. Stevenson said, "The brief account which has been given of the medicine orders of the Zuñi is perhaps sufficient to convey an understanding of this interesting phase of the pueblo life of North America. The dignitary, who is usually called the 'medicine-man' among our Indian tribes, is something more than the term implies in civilization. The medicine-man is both priest and doctor, and, by reason of his priestly office, he sometimes becomes a judge. The mythical beings with whom he holds converse are the gods of his people. They are the persons who bring evils, or preserve from evils: they bring health or disease, they bring peace or war, and they bring plenty or want at harvest time. Thus in all respects the gods are supposed to hold within their power all prosperity and all adversity. So the priests stand between the people and these gods, and by means of ceremonies, incantations, and many prescribed observances, the gods are induced to preserve from evil and bring happiness. The medicine practices of the Zuñi are therefore religious observances and rites; and the daily life of the Zuñi, under the guidance of their priests through the agency of the medicine order, is so controlled that every act of life assumes something of a religious character. To them their religion is fraught with much fear; to them it brings many trials, many privations, and much suffering. Notwithstanding this, they derive from it much amusement and great joy, and in it all their hopes and aspirations are centred."

Early Stages in the Life of Taenia Pectinata.

Thousands of sheep and lambs perish every winter on the ranches west of the Missouri River. They are not apparently afflicted with any disease. They are weak and lean in the fall, and simply seem to be unable to withstand the severity of the blizzards. The Bureau of Animal Industry, of the Agricultural Department, has been engaged in an investigation to ascertain, if possible, the cause of the weakness of the animals that perish, and Mr. Cooper Curtice visited the West in the prosecution of this work. An examination of the viscera of slaughtered sheep and lambs, fat and healthy ones as well as those that were weak and lean, disclosed the fact that they were almost without exception infected with tape-worms, which were found in the duodenum and gall-duct. In the latter they were frequently so numerous as to close it up, and cause a suspension of its functions.

For the purpose of continuing his studies, Mr. Curtice brought from the West a number of lambs, which were killed at intervals and their viscera examined; and this material having been exhausted, and it being inconvenient and expensive to obtain more, he turned his attention during the past winter to a study of the early stages in the life of the *Taenia pectinata* (common unarmed tape-worms of the rabbit). In studying these, Mr. Curtice thinks that he has made some interesting discoveries, which he presented to the Biological Society of Washington at a recent meeting.

The variety examined is found abundantly in nearly all rabbits in this locality. The life-history of the armed tape-worms of man and dogs has long been written; but that of the unarmed species inhabiting our domestic animals, especially cattle and sheep, is as

yet comparatively unknown. As far as has been ascertained, the life-history of the *Taenia pectinata* is embraced in two stages. The first covers the development of the ova into the embryo, which is ready to leave the parent *Taenia:* the other covers the period of growth from the youngest forms yet found in rabbits to the adult stage. The life of the *Taenia* from the time they leave the first rabbit as an embryo, until they are found as young *Taenia* in the second rabbit infected, has as yet been unascertained. Among the theories that have been advanced, is one that they pass this stage upon the ground, are eaten by insects, snails, or crustaceans, and that these are then eaten by the rabbits. This, however, is only a theory, as none have ever been found in snails, insects, or crustaceans.

It was Mr. Curtice's good fortune to find a rabbit which had recently been infected with these peculiar parasites, none of which were over three centimetres in length, many of them being less than five millimetres long. There were more *Taenia* in that rabbit than any he had ever seen before, — about eighty-five. Among the smaller *Taenia* were several specimens that showed the stages of development from non-segmented, armed forms, to segmented, unarmed forms. Mr. Curtice showed to the society specimens illustrating the different stages.

The youngest forms detected were not the smallest, but measured about one-half a centimetre in length. They contained, in addition to the four suckers, a cup-shaped cavity in the place of the rostellum. Around the border of this cup-shaped cavity were situated eighty-five or ninety hooks. The older specimens show a similar cavity, with no hooks. Still older ones show no cavity at all. All of these were in the non-segmented stages; but other forms, some of them smaller, were without signs of hooks, and had already begun segmentation.

Mr. Curtice compared these stages with similar stages in *Taenia serata*, and said that the youngest stage of the *Taenia pectinata* was probably a cysticercoid stage, and not the cysticercal, and that this was indicated by the cup-shaped cavity in the youngest forms of the *Taenia pectinata*.

In discussing the classification founded on the presence or absence of hooks, he declared it to be incorrect, since the discovery described above shows that the unarmed species in adult stages are armed in earlier stages.

The speaker exhibited some elegant drawings made by Dr. George Marx, illustrating the embryo as it leaves the parent *Taenia*. This embryo is six-hooked, and surrounded by a curious pyriform envelope, to which there is a double prolongation surmounted by a cap of the same substance. The cap has a shredded border, and is believed to be the remnants of a mass which, in an earlier stage, completely surrounded the embryo. This peculiar envelope has been previously noticed in Italy by Perroucito, and in France by Raillet. This stage is similar to that found in *Taenia expansa*, the unarmed tape-worm in sheep.

Implanting Teeth.

Dr. Yonger of San Francisco was the first dentist in this country to perform successfully the experiment of implanting teeth. This process is not to be confounded with transplanting teeth, which has been practised by dentists for many years. In the latter operation, a tooth freshly extracted is inserted in a socket from which one has just been drawn, and the parts unite, circulation between the jaw and the tooth is established, and the latter actually takes the place of its predecessor.

In Dr. Yonger's experiment, the tooth to be replaced has long been extracted, and the socket filled up with bony substance. He drills into the jaw, gouges out a new socket, and then, taking a tooth that has long been extracted, cleans it thoroughly, soaks it in bichloride of mercury, and inserts it in the socket just formed. This new tooth in due time becomes firmly anchored, and as serviceable as the original one before it became decayed. Dr. Yonger holds that the tooth is held in its place by the soft tissues surrounding it, and that the artificial socket has nothing to do with anchoring it.

The experiment described above was performed by Dr. G. M. Curtis of Syracuse, N.Y., who afterward extracted the implanted tooth, and sent it to Dr. W. M. Gray, the microscopist of the surgeon-general's office, who has made a very careful examination of it. His experiments prove beyond question that the tooth so implanted is revived, that circulation is established between the socket and the implanted tooth, and that the socket does take an active part in anchoring the tooth. A tooth so implanted is much more firmly anchored in the jaw than one of the originals, and, in the case referred to, the tooth was held so firmly that Dr. Curtis broke it in extracting it. Dr. Gray does not doubt that the soft tissues do take an active part in the operation, but he has proved his propositions in regard to the bone and the tooth beyond all question.

Some Recent Discussions of Target-Shooting.

At the last meeting of the Mathematical Section of the Philosophical Society, Mr. Charles H. Kummell read some remarks on some recent discussions of target-shooting. In opening, he briefly reviewed a previous communication on the same subject which he had made in 1883, stating as the fundamental assumption (there credited to Liagre, but due apparently to Poisson), that the deviations of the shots from a vertical axis, called sighting errors, and those from a horizontal axis, called levelling errors (each axis passing through the centre of the target), each independently follows the exponential law of error. One of the most important consequences of this assumption is, errors of shooting of equal probability are on the circumference of an ellipse whose axes are in the ratio of the mean sighting and levelling errors. Among the writers on the same subject, Mr. DeForrest, in the Transactions of the Connecticut Academy, vol. vii. 1885, requires not only the sighting and levelling axis, but even the centre of the target, to be ignored, and a new centre and system of free axes determined from the distribution of the shots on the given target. Mr. Kummell thinks this method of discussion quite proper, if we really were ignorant of the true position of centre and axes. But, such not being the case, a merely probable thing should not be preferred to a fact.

In the January number of *Comptes Rendus*, 1888, Mr. J. Bertrand objects to the previous methods of discussing target-shooting, on the ground that the levelling and sighting errors are not independent, but admits that in some as yet unknown curve (not an ellipse) would be found shots of equal probability, and proposes to establish one of these curves for any given target by dividing it into a convenient number of sectors, and taking the mean shot in each. Mr. Kummell inquires what this discussion will lead to. It is certainly too rough for a limited number of shots, and whatever curves may be found in any special case, they will be sufficiently near ellipses, as required by Poisson's assumption.

The Drift North of Lake Ontario.

The short paper upon this subject read by Prof. J. W. Spencer before the Philosophical Society at its last meeting was a generalized description of some of the obscure and conflicting phenomena of the drift.

Among the deposits of the later pleistocene period, he said in substance, there is a well stratified, hardened, brown clay charged with pebbles more or less glaciated, resting upon typical blue bowlder clay, north of Toronto. In the Canadian classification of the pleistocene deposits there is no place for this deposit. Indeed, all of the stratified deposits of this region need revision in the light of the progress that has been made in surface geology during the last twenty years. Thus the Saugeen clay is resolvable into three series. The relation of all the clays to the older beaches requires special study, as a part of them probably represent the deep-water deposit of the beach epoch, while some of the later beaches rest upon such clays.

Around the head of Georgian Bay there are ridges in the form of moraines, similar to those about the other Great Lakes, reaching to the height of thirteen hundred to fourteen hundred feet above the sea. From the face of the Niagara escarpment — between Georgian Bay and Lake Ontario — there extends for over a hundred miles, to near Belleville, a broad zone of from eight to twenty miles in width, covered with drift-ridges composed of stony clay below, and frequently stratified clay or sand above, having an elevation of from eleven hundred to twelve hundred feet above the sea, with occasional reductions to nine hundred feet. These 'Oak Hills or Ridges' rise from three hundred to five hundred feet above the flat paleozoic

country to the north. The stones in the clay are glaciated, often of limestone, with only a small proportion of crystalline pebbles or bowlders. In the deposits of the ridges, native copper has been found: consequently the drift-carrying agent moved south-eastward down Georgian Bay, to the west end of the Oak Ridge, and probably throughout its whole length. North and east of Belleville there are many more and fragmentary ridges having a trend somewhat across that of the Oak Ridge.

The glaciation of the region adds great difficulties to the explanation of the phenomena. The striation in the Ottawa valley, from Lake Tamiscamang to the junction of the St. Lawrence, is to the south-eastward, with very rare local exceptions. On the Niagara escarpment, between Georgian Bay and Lake Ontario, from sixteen hundred down to seven hundred feet above the sea, the striæ are also to the south-east; but between these widely separated regions the surface markings of the rocks are obscured to the west and south by drift, and to the north and east are absent and rarely seen, although the crystalline rocks are commonly rounded or very rarely polished, — an absence that can only in part be accounted for by subsequent erosion. About the St. Lawrence and Lake Ontario the striations are to the south-west or west. Between the Ottawa River and Georgian Bay there is a high prominence which divided the drift-bearing currents; but north of Lake Huron the glaciation is very strongly marked, and the direction is to the south-west, with very rare local variations.

All the lobes of glaciation about the Lakes, from Superior to the Ottawa valley, radiate backwards to the broad and open, but low basin of James's (Hudson) Bay. The watershed between the Lakes and Hudson Bay, during the epoch of the formation of the drift, was several hundred feet lower than now, — which is about sixteen hundred feet at present, — as shown by the differential elevation of the beaches.

For these conflicting phenomena of the drift no explanation was offered, but rather sought for.

Some remarks upon the paper were offered by Mr. Gilbert, who had observed the slight amount of erosion in the Ottawa valley; but he thought that generalized explanations of the drift were very often contradicted when applied to special regions, and that our knowledge of the phenomena would not at present give a satisfactory explanation.

Determination of Atomic Weights.

Prof. F. W. Clarke, in a paper on the determination of atomic weights, read before the Philosophical Society at its last meeting, discussed the sources of error in such constants, both with regard to the processes of weighing and to the chemical considerations involved. He dwelt especially upon the uncertainty in the atomic weight of oxygen, which affects the atomic weights of nearly all the other elements, and urged the importance of other determinations which should not hinge upon oxygen. Prout's hypothesis, now of importance in all discussions as to the nature of the chemical elements, requires the most precise determination of atomic weights, and none of the latter are yet known with enough certainty to settle the question at issue.

Distribution of Indian Tribes in North America.

The United States Geological Survey has nearly ready for publication a map showing the distribution of the Indian tribes on this continent north of Mexico. Including the labor which Major Powell himself and his immediate assistants have expended in the collection, arrangement, and digestion of the material for this map, and that done by the Bureau of Ethnology, it will represent the work of about fifteen years, and will be one of the most important and interesting publications ever made by the Geological Survey. All of the Indians living in this country at the time of the white occupation have been divided into linguistic families, and the territory occupied by each one of these families is represented on the map by a distinctive color. The number of these families is about 60, and the number of separate tribes between 300 and 350.

One of the first and most important facts shown by this map is that the territory occupied by each linguistic family, with few exceptions, is continuous. An important deduction in relation to the habits of the Indians is drawn from this fact, — that instead of being nomadic, and wandering over the continent at will, as has been generally supposed, the Indians had fixed homes, the boundaries of which were almost as plainly marked as the dividing lines between the several States are to-day, and that their wanderings were within limited areas, rarely or never extending beyond these fixed boundaries. The Indians had their permanent villages, in which they lived for five, ten, twenty, or perhaps fifty years. At certain seasons of the year they went to the coast or to the rivers to fish, or to the forest or plains to hunt. The boundaries of the territories occupied by each family were occasionally changed by conquest. A stronger tribe or family would by war push back its weaker neighbors, and thus extend its dominion. But the territory so conquered was recognized by the vanquished, as well as by the victor, as the property of the latter. If the Indians had been nomadic, and wandered over the continent or over large portions of it, branches of the same linguistic family would have been found scattered broadcast all over the country.

Some of the few exceptions to this general rule of distribution are exceedingly interesting, and throw a light upon the unwritten and even forgotten history of some of the tribes. For instance: a little colony of the great Siouan family is found in Virginia. How it became separated, crossed the mountains, and maintained itself in the midst of another family speaking an entirely different language, suggests a very interesting topic for the study of the ethnologist. Again: all the north-western part of the continent was occupied by the Athabascan family, very peaceable Indians. But the Apaches and Navajos of New Mexico and Arizona belong to the same family, and are among the most warlike on the continent. To their surroundings and the necessity of wresting their new home from its previous occupants and holding it, as well as to the inhospitable character of the country, may not their change of character be attributed? Another little tribe of the Athabascans is found in California.

One of the most degraded families of Indians of North America is the Shoshonean, of which the Diggers are a branch. And yet, strange as it may appear, the Moquis, more advanced toward civilization than any others of the Pueblo Indians, are Shoshonean.

One exceedingly interesting feature of the map is the great number of little families that lived in California and Oregon. Some of these comprise only a few individuals, — not more than forty or fifty, — and yet their languages are entirely distinct from those spoken by the surrounding tribes. In one instance Mr. Henshaw, who has charge of the construction of the map, found in California a single man, the sole survivor of his tribe. From him enough was learned to preserve the language once spoken by his ancestors, but with his death that tongue becomes extinct.

A very curious fact in relation to the distribution of the Eskimo is that they inhabit the coast of the Arctic regions to the exclusion of other Indians, beginning on the east shore of Greenland, and following the coast-line of that island around to the point farthest north inhabited by man. Then, beginning on the coast on the mainland, they occupy narrow strips on the north shores of Hudson Bay and along the northern coast of the continent, around past Bering Strait, and down the north-west coast of the continent to Prince William's Sound. Throughout all this immense coast-line the differentiation of language is very small; so that an Eskimo from Greenland transported to Bering Strait would in a month be able to speak the language of the natives there as well as though he had been born there. In striking contrast were the numerous distinct families of Indians in the valleys of California and Oregon, whose languages are so different that they could not understand each other.

This map, when published, will be accompanied by a report and discussion of the facts it discloses, and will be a very important contribution to the science of ethnology.

HEALTH MATTERS.

Malaria.

THE subject of malaria has always been a most interesting one for the study of the physician. Until the year 1879 its origin was obscure, although various theories were advanced to account for it. Klebs and Tommasi-Crudeli, in 1879, discovered in the soil of the Roman Campagna a bacillus, to which they gave the name *bacillus malariæ*, and to which they attributed malarial disease. In 1881 Laveran, a French surgeon in Algiers, discovered

the *plasmodium malariæ*, which he found in the blood of patients suffering from malaria. The views of Laveran are to-day the most generally accepted. Councilman, Osler, and Sternberg, all American physicians, have given much attention to the subject, and, so far as we know, have in general accepted Laveran's views. Dr. M. B. James of New York recently read a paper on this subject before the New York Pathological Society, which is published in the *New York Medical Record*. He says that at present our knowledge may be summed up as follows: —

"In the blood of persons suffering from malarial disease there is a series of phenomena not yet found under any other conditions. These phenomena point to the presence of an animal parasite. The appearances that we get are one or more of the following:

"*First*, Colorless protoplasmic bodies inside the red blood-corpuscles. They vary in size from one-fifth to almost the whole diameter of the corpuscle. They exhibit active amœboid movements. Some contain scattered granules of brownish-black pigment; others are unpigmented. The red corpuscle which contains the amœboid body is commonly larger, flatter, and paler than normal.

"*Second*, We find disk-shaped bodies of colorless protoplasm. They are somewhat larger than a red blood-corpuscle. They show no amœboid movements. They contain scattered pigment-granules. They are apparently a later stage of the form first mentioned, which has come to occupy the entire corpuscle, and has then entered upon a cyst stage.

"*Third*, We find forms similar to the cysts, but in which the pigment-granules have become massed at the centre, while the protoplasm is undergoing segmentation. Then there are found various stages in the transition from the encysted to the segmentary form.

"*Fourth*, We have the small masses of protoplasm that have resulted from the segmentation of the cyst form. They are commonly somewhat oval in shape. In fresh blood it is difficult or impossible to distinguish them from blood-plaques. In dried blood they show a tolerably characteristic bipolar staining with aniline dyes.

"*Fifth*, We have hyaline bodies of crescentic shape, in length rather more than the diameter of a red blood-cell. They have, in every case, a collection of pigment-granules in their centre. These are the so-called 'crescentic bodies.'

"In some cases there are found bodies resembling the crescents closely in character, but elliptical or round. The crescents may have a delicate curved outline opposite the concavity or convexity, or both, but this outline never reaches quite to the tips of the crescent.

"Lastly, there are the various motile bodies. These are, first, flagellated bodies, — a round or pear-shaped body, about one-half the diameter of a red blood-cell. It contains pigment-granules, and is provided with from one to four flagella, which show an active lashing motion, and by means of which the organism moves about in the blood-plasma. The flagella are several times as long as the diameter of a red cell. Their motion is active enough to set up well-marked movements on the part of the neighboring blood-corpuscles. Second, free flagella have been described. They seem to have become detached from their bodies, and to be capable of leading an independent existence. They exhibit active movements. Third, some observers have described hyaline pigmented bodies with an actively moving, undulating periphery."

In thirty-five cases in which Dr. James had an opportunity of studying the blood, he found the parasite in thirty-four. In one case, in which he was able to examine the blood but once, he failed to find it. In several cases where the diagnosis was doubtful he has been able to exclude malaria by failing to find the plasmodium, and the subsequent history has confirmed the microscopic examination.

The microscopic technique is simple. The blood is best examined fresh, spread out in the thinnest possible layer, — the rouleaux of corpuscles broken up. High-power objectives are necessary. A $\frac{1}{12}$-inch oil immersion answers well.

Stained specimens are best prepared by drying the blood in a very thin layer on a cover-glass, which is then passed through a flame, as in examining for bacteria. It may be stained in a watery solution of an aniline dye, washed out in water, or partly decolorized in alcohol, and mounted, as usual, in balsam. Fuchsine and methylene blue give the best results. Dr. James finds methylene blue most satisfactory, the red corpuscles staining light green, and the hæmatozoa blue.

Unpigmented amœboid bodies are best studied in stained specimens. The pigmented amœboid bodies, which are those most commonly met with, are best seen in fresh blood. The crescents also show most satisfactorily unstained. The segmenting bodies and free spores are best studied after drying and staining.

The apparent effect of medication on the organism is important.

A few large doses of quinine are almost invariably followed by a disappearance from the blood of the various amœboid forms. The crescentic bodies remain unchanged after quinine, but commonly show a diminution in number as the health improves under the treatment proper for chronic paludism.

These apparent results of treatment followed in his cases as in those of most other observers. The organism has not yet been discovered except in human blood and organs. It has never been isolated. It has never been cultivated outside the body.

Inoculative experiments on human beings are almost uniformly successful. Intravenous injection of malarial blood into a healthy individual is followed by typical intermittent fever, with the appearance in the blood of the second person of the various forms of the organism described. These experiments have been made by Gerhardt in Germany, and by Marchiafava and Celli and other Italians.

Subcutaneous injections have been unsuccessful.

The few inoculative experiments that have been made upon monkeys have been unsuccessful.

As regards the name of the organism: the term 'plasmodium has been improperly used in this connection. This name has long been applied to a segregation stage of some of the mycetozoa, and so means, not a particular organism, but a stage of development common to many different organisms. Moreover, so far as we know, the malarial germ has no plasmodium stage.

It is much better, then, in designating the malarial organism, to use the term 'hæmatozoon of malaria,' as suggested by Laveran, which commits us to no definite classification.

TYPHOID INFECTION. — The investigation into the outbreak of typhoid-fever at the Michigan State Prison at Jackson by Prof. V. C. Vaughan has resulted in obtaining facts which tend strongly to prove that the outbreak was due to defective sewerage. We have repeatedly maintained in *Science* the probability that sewers and house-draining were efficient agents in the propagation of typhoid-fever, basing our opinion upon a large number of cases which occurred in Brooklyn in 1885, in which all other sources seemed to be excluded. In the investigation which Professor Vaughan made, the water-supply and milk-supply were first ruled out as possible vehicles by negative evidence. It was then thought that the defective condition of the sewers, combined with the insufficient supply of fresh air, was the most probable cause of the epidemic. The cases nearly all were from a distinct portion of the prison, and investigation proved that the soil-pipe running from the hospital, and the house-drain, into which it entered, were defective, and were pouring sewer-air into that portion of the prison. Professor Vaughan took to his laboratory a sample of the air from within the soil-pipe, and has found within it the specific germ of typhoid-fever. Such facts as these are of the greatest practical importance, and should be made a matter of record whenever they are observed, and should be widely disseminated. They show the absolute necessity for thorough disinfection of the excreta of typhoid-fever patients, and the dangers which may and probably will result from a neglect of this important measure. Had the discharges from a single typhoid-fever patient been efficiently disinfected, the devastating Plymouth epidemic, which resulted in the sickness of 1,153 persons, and the death of 114, and a total money-loss of $115,539, would never have occurred.

GRAFTS ON WOUNDS. — Dr. Redard has communicated to the Académie de Médecine of Paris, according to the *New York Medical Record*, some observations regarding animal grafts on wounds in human beings. In a case of severe burn of the scalp, of eight

months' standing, in a child two years of age, he obtained a rapid cicatrization by means of grafts from a fowl. He first tried grafts of frogs' skin, but as these proved to be repulsive to patients, and did not give very good results, he substituted others from the fowl; and the wound, which measured three inches by two and a half, had completely healed in two months. He had been equally successful in other and subsequent cases. He takes the skin from beneath the wing of a chicken, carefully securing the subjacent cellular tissue, but avoiding adipose tissue. The transplanted pieces varied from a sixth to a third of an inch in size, and they were maintained in position by means of a little cotton-wool and iodoform gauze. The skin of birds and fowls has the advantage of being supple, delicate, and vascular: it adapts itself readily to the surface of the wound, and adheres without undergoing absorption.

THE HUMAN BREATH. — Professor Brown-Séquard has recently been making experiments to determine whether the human breath was capable of producing any poisonous effects. From the condensed watery vapor of the expired air, he obtained a poisonous liquid, which, when injected under the skin of rabbits, produced almost immediate death. He ascertained that this poison was an alkaloid, and not a microbe. The rabbits thus injected died without convulsions, the heart and large blood-vessels being engorged with blood. Brown-Séquard considers it fully proved that the expired air, both of man and animals, contains a volatile poisonous principle which is much more deleterious than carbonic acid.

ELECTRICAL SCIENCE.

Electrical Traction.

IN the last two or three years a number of street-car lines have been equipped with electric motors, and most of them have been successful in spite of the inexperience of those who have done the work, — an inexperience due to the newness of the field. The number of electric railroads under way is increasing rapidly, and for certain classes of work the motor seems destined to take the place of the expensive and overworked car-horse.

As yet the greater part of the lines equipped have been for city tramways, generally in the suburbs, where there is comparatively little street traffic. This, however, is only a beginning, more useful in the experience it gives, and in the problems that are brought up and solved, than in the absolute results: for the question of the application of electricity to traction is a very broad one, and does not stop at street-railways. The elevated railroads may be run by electric motors; already motor cars are used in mines, where there is an extended field for their use; and it is possible that a few years will displace the steam locomotive, and substitute in its place powerful electrical locomotives.

There is no apparatus for the transformation of energy that compares in simplicity and efficiency with the dynamo-electric machine and electric motor. The steam-engine transforms perhaps fifteen per cent of the energy of coal into mechanical work; while the efficiency of a good dynamo may be ninety-two per cent, and a motor may have as high an efficiency. If, therefore, we transform mechanical work into electrical energy by a dynamo, and retransform it to mechanical work again by a motor, we have a total loss of perhaps fifteen per cent. It may be easily shown that in many cases it would be profitable, by taking advantage of the higher efficiency of large-power plants, and the comparatively small cost of attendance, repairs, etc., per horse-power, to generate all the mechanical energy needed in a district at some central station, and distribute it by dynamos and motors to the consumers, displacing the small steam or gas engine plants previously used.

For traction-work the problem is not to replace stationary steam-engines or gas-engines, but to replace horses, cables, and locomotives. This problem is being attacked, and will doubtless be at least partially solved.

Before taking up the relative merits and cost of different systems, let us consider the broad questions that are involved. The questions are, (1) How can we best produce the electrical energy needed? (2) How can we best get it to our motors? and (3) After we get it there, what is the best way to apply it to traction?

Under the first head there are a good many things to consider, and many of these can only be answered by knowing the exact conditions of our installation. We can say generally that for a given horse-power needed at our motor we should so choose our source of power and location of generating-station that the interest on first cost of plant and conductors (supposing we use them), the total depreciation, and the cost of the power *generated*, should be a minimum.

We will discuss these questions more fully when we come to the question of cost. To show the nature of the problem that might arise, suppose we have a railroad line from Philadelphia to New York to be run by electric motors. We would possibly find it best to have a number of generating-stations along the line, at distances apart of, say, twenty miles. Now, if there were no natural sources of power near the tracks, we would have to calculate the best distances apart for these stations, knowing the cost for a horse-power with plants of different sizes, the cost of copper for conductors, the cost of a ton of coal at different points on the line, etc. The problem would not be a difficult one. If, however, there was at some distance from the line a source of natural power, — a waterfall, for example, — we would have to redistribute our stations, and calculate whether it would cost less or more to utilize the waterfall, decreasing the cost of power, in that we do not have to pay for coal, but increasing the size of plant for a given electrical energy at the line (for we must supply the needed energy *plus* the loss on our lines), and increasing the outlay in conductors. Of course, this is all a very definite question, presenting little difficulty to the electrical economist. When we consider that some railroad lines have distributed near them water-power capable of running all of their trains, with help at long intervals from steam-generating stations (even windmills are not to be despised in some cases), and when we further consider that the conditions are much simpler than in city traffic (we can use high potentials and unsightly devices if we choose), it encourages one to predict a future for electric railroads.

If, as I have so far assumed, we are going to transmit the electrical energy to the motors by conductors, it is evident that the potential we can use comes in as a factor. In cities we are usually limited to a comparatively low potential, — a maximum, say, of five hundred volts. This has the effect of locating our generating-station as near the line as possible, — in the middle of the line if we can get it there, — for the cost of conductors would be great if the station were too far from the line. We will have more to say on this in any early number.

ELECTRICAL TREATMENT OF SEWAGE. — Mr. William Webster, F.C.S., has patented a process of purifying sewage by means of the electrical current. The pollution of rivers by the sewage of large cities is a constant source of danger to health; and, according to the London *Standard*, £1,000,000 is to be spent in attempting, by the employment of chemicals, to purify the London sewage. Mr. Webster's plan consists in sending a current of electricity from metallic electrodes through the sewage. The result, in experiments made on a very small scale, is to set the solid particles held in suspension in motion, "a kind of procession taking place from the top downwards, and from the bottom upwards. The sum-total of the movements consists in landing the suspended particles at the top of the liquid." "So prompt is the effect of the electric current that in twenty minutes a volume of opaque sewage becomes perfectly transparent, except at the top, where the organic matter collects in a semi-solid form." "From results already obtained it is calculated that the cost of the electrical treatment of the London sewage would be about £25,000 per annum. The annual outlay for chemicals is expected to be £18,000 for lime and iron, and £12,000 for permanganic acid, making a total of £30,000, a balance of £5,000 in favor of the electrical method. It would seem that Mr. Webster's experiments have, as yet, been on a small scale. If the practical results bear out what has been done in the laboratory, the process will be of the greatest importance.

TRANSFORMERS. — Two papers on this subject, read before the Society of Telegraph Engineers and Electricians, — one by Mr. Kapp, the other by Mr. Mackenzie, — have excited considerable discussion and interest on this subject of commercial induction-coils. Mr. Kapp's paper treats of the relative merits of different forms of transformers, and his methods are simple and easy of

comprehension. In all of this work on alternating-current apparatus the assumption that the electro-motive force and the currents follow simple sine curves is made; and, while the error in the assumption may or may not affect conclusions as to the types of action that occur, yet it must vitiate any attempt to deduce absolute values. Up to the present the subject of alternating currents has been singularly barren of experiments, while quite a number of problems have been solved by analytical and graphical methods. It is well known that a great many effects are not taken into account in the ordinary treatment, but the value of these outside effects has not been determined. The full discussion of these papers has not reached this side of the ocean: what has reached us is interesting and important, and will be given when the rest of it arrives.

BOOK-REVIEWS.

Chambers's Encyclopædia. New ed. Vol. I. A to Beaufort. Philadelphia, Lippincott. 8°. $3.

THE original issue of this work was completed twenty years ago, and few works of the kind have enjoyed an equal popularity, or rendered better service to the mass of readers. It is, of course, not to be compared in elaborateness with the *Britannica*, the articles in which are often in the form of lengthy treatises; but for non-professional readers, who do not wish to make a special study of the various branches of knowledge, but seek for general information on all subjects that arise in reading and conversation, this work has proved very valuable. The progress of events, however, and the increase of knowledge in almost every branch, have necessitated a new edition, the publication of which has now been begun. Many articles have been rewritten, and others partially so, while all have been subjected to a careful scrutiny by competent hands; and the result, so far as we have examined the work, seems to be excellent. Considerable attention has been given to American subjects, the more important of which have been treated by American writers; and their articles have been copyrighted in the United States by the J. B. Lippincott Company of Philadelphia, who publish the encyclopædia in this country. There is an article, however, on Americanisms in language, by an Englishman, Mr. Grant Allen, which contains some great mistakes. Thus, he says that "the speech and writing of the uncultivated classes diverge increasingly from the pure literary English standard;" the fact being that the language of the uncultivated Americans tends increasingly towards the literary standard, owing to the influence of the public schools and the growing taste for good reading. But most of the articles on American subjects are very good. One of the most difficult tasks in preparing an encyclopædia is to allot the right proportion of space to the various subjects treated, and in this respect the editors of this work have been quite successful. If the remaining volumes are up to the standard of the first, the encyclopædia will deserve and receive a renewal of the favor it has hitherto enjoyed.

Familiar Animals and their Wild Kindred. By JOHN MONTEITH. Cincinnati and New York, Van Antwerp, Bragg, & Co. 16°.

THE idea of presenting school-readers for youthful scholars, treating of familiar topics in natural science, is not a new one, but it is a thoroughly good one. The writer well remembers the permanent interest in every thing pertaining to natural history engendered in him by the use of the Wilson series of readers in years gone by. Such reading-exercises have been improved since that time, however, though there is still room for improvement. In no way, in the hands of a good teacher, can a child's powers and aptitude for self-observation be better stimulated than by well-prepared reading-exercises treating of the familiar forms of life. The knowledge imparted in such exercises should be accurate and comprehensible, but scarcely less important is the manner in which it is presented. A description that leaves nothing for the child himself to find out, no conclusions for him to draw, is of but secondary value. His faculties for thinking and observing, not his memory, need the most training.

The present school-reader, for that is what it is, meets fairly well these requirements, and, taking it all in all, merits commendation. It is intended for children of the third-reader grade, or say from eight to ten years of age, and is not only interesting, but instructive to them. The habits and anecdotes of the domestic and other familiar animals and their wild kindred are presented in pleasing shape. The material is largely adapted from known writers, or drawn from such authorities as Mivart, and is reliable. The engravings are good. Only mammals are treated of, and nowhere is the erroneous impression corrected that the word 'animals' is synonymous with four-footed mammals.

A Catalogue of Canadian Birds, with Notes on the Distribution of Species. By MONTAGUE CHAMBERLAIN. St. John, J. & A. McMillan. 12°.

THIS is an annotated list of the birds hitherto recorded or observed as residents or visitants of the vast and ill-explored region north of the United States. It is in reality the first attempt of the kind, and can only be looked upon as preliminary; but, though only a preliminary list, it has required labor, and will be very useful for future workers in Canadian ornithology, — a branch which, when we consider the excellent work done by the Canadian entomologists and botanists, has been much neglected in the Dominion. Notwithstanding the future revision which this list must be subject to, the author might have added to its value by tabulations after the manner of Merriam's work. By counting, it is ascertained that the whole number of species and sub-species recorded is nearly five hundred and fifty.

The Story of Creation, a Plain Account of Evolution. By EDWARD CLODD. London and New York, Longmans, Green, & Co. 12°. $1.75.

OF book-making on evolution there is yet no end. The present little work, however, presents a claim for recognition, not as an exponent of new views, theories, or facts, — for, as the author very naïvely admits, there is probably not a new idea in it, — but rather as an elementary exposition, a text-book, of the subject. As such, it will hardly find a place on the shelves of either the professed physicist or biologist, save as a fairly good epitome of the materials and methods of evolution in its widest sense. But to him or her who would not decry or accept Darwinism without some knowledge of the subject, and that fashion is happily subsiding, the work can be heartily commended. The author, while treating his subject in a scientific manner, has endeavored to make his book popularly readable; and he has succeeded fairly well, though the compression of so vast a subject into one small volume could hardly fail to produce a text-book-like concentration that will deter the mental dyspeptic. More than half the volume is made up of descriptive matter, both physical and biological, of the earth and the universe: the remainder is explanatory of their development or evolution, including man psychologically. In other words, as already stated, the author strives to give a brief exposition of the materials and methods of evolution in its widest sense. There are numerous good engravings, and the statements of fact, at least on the biological side, are in general fresh and reliable. The author might very properly modify the paleontological fiction of the thirty by one hundred foot Jurassic monster. It has never existed, for aught that is known. save in the describer's imagination: the figures need reduction one-half.

Practical Physics for Schools. Vol. I. Electricity and Magnetism. By B. STEWART and W. W. H. GEE. New York, Macmillan. 16°. 60 cents.

MOST physicists and many teachers of physics are already familiar with the two volumes on 'Elementary Practical Physics' by Messrs. Stewart and Gee, and nearly all will agree that they constitute an extremely valuable contribution to the facilities now available for the successful prosecution of instruction in physics by laboratory methods. The small volume now under consideration, since the word 'elementary' is omitted from its title, might be assumed to be more pretentious in its plan and execution than the others.

The contrary is the case, however, as it is intended for a lower grade of work. It is, as the titlepage has it, "for schools and the junior students of colleges."

To a considerable extent the book is an abstract, with simplifications, of the second volume of the other series. It is not entirely

so, however, as there are numerous additions, and, what is most notable, the plan of the work in one particular differs radically from that of the larger and more complete volume. The original series from which this is derived is intended to serve as a laboratory guide, and must be used in connection with some good text-book. The present volume is so written as to be available as both a text and a laboratory book, but it will probably be found more useful as a working handbook, and as an adjunct to a well-prepared text. The explanations of principles are invariably good, but not always sufficient, the necessities of the case requiring a degree of condensation sometimes incompatible with great simplicity. In common with the other members of the family to which it belongs, the book has great merit. In the beginning there is an introductory chapter on fundamental measurements and measuring instruments; there is next an excellent chapter on electrostatics, but which will appear to be somewhat long to some American teachers whose ambition seems to be to reach the dynamo-machine in the shortest possible time; then follows a chapter on magnetism; and the remainder of the book is devoted to voltaic electricity, electrical instruments, and measurements. There is an appendix, which, besides some additional practical hints to teacher and pupil, furnishes a price-list of instruments and materials needed for the laboratory and laboratory workshop, and complete plans, drawn to scale, of three recently established school laboratories. These will be of great service to those contemplating such additions to their school equipment; and the book, as a whole, can be strongly recommended to all interested in the advancement of elementary instruction in physics.

Among a few defects of minor importance may be mentioned the strict adherence, peculiar to English authors, to the concave mirror and scale for galvanometer and other purposes, omitting the consideration of the plane mirror and telescope method, which is often much better and much more available than the other. Taken in connection with the other series by the same authors, the title of this volume is unfortunate, and likely to lead to considerable confusion in making orders, references, or quotations.

The New Astronomy. By SAMUEL PIERPONT LANGLEY. Boston, Ticknor. 8°.

"I HAVE written these pages, not for the professional reader, but with the hope of reaching a part of that educated public on whose support he is so often dependent for the means of extending the boundaries of knowledge.

"It is not generally understood that among us not only the support of the government, but with scarcely an exception every new private benefaction, is devoted to 'the Old' Astronomy, which is relatively munificently endowed already; while that which I have here called 'the New,' so fruitful in results of interest and importance, struggles almost unaided.

"We are all glad to know that Urania, who was in the beginning but a poor Chaldean shepherdess, has long since become well-to-do, and dwells now in state. It is far less known than it should be, that she has a younger sister now among us, bearing every mark of her celestial birth, but all unendowed and portionless. It is for the reader's interest in the latter that this book is a plea."

The purpose of Professor Langley's book, as well as the charming style in which it is written, are so well set forth in his brief preface, that we have quoted it entire, as above. Supplemented with the clear statement of the opening pages, that the prime object of the old astronomy has been to tell us *where* the heavenly bodies are, while the new endeavors to tell us *what* they are, the reader has at once a clear idea of the scope and aim of this most interesting book. Though not written for the professional astronomer, none such can read it without interest and profit, even if for nothing more than as an excellent example of how to present his hard facts in a pleasing and attractive dress; while every intelligent reader will be pleased not only with the manner of presentation, but with the matter presented; and so plain and easy is the pathway made, that the unprofessional reader has little idea of the months and years of patient investigation — much of it the author's own — which have made these plain and easy statements possible. Rarely, too, or rather never before in an astronomical work, have engraver and publisher so happily united in giving a literary gem so beautiful an artistic setting. The first chapter especially, on 'Sun-Spots,' is rich in beautiful drawings from the author's own pencil while at Allegheny; and those who recall the wonderful frontispiece of Professor Young's excellent work, 'The Sun,' will desire to feast the eye upon the large number of equally fine drawings in the present work. Printed at the University Press of John Wilson & Son, Cambridge, Mass., and upon paper so heavy that the only drawback is the reader's constant fear that he has turned three or four leaves at once, the whole is a beautiful specimen of the bookmaker's art, and a gem which every educated man should possess.

We can only notice in the briefest way the contents of the eight chapters of the book. The first four are given up to the Sun (and after reading them we think the reader will join with us in a request to the compositor to set this with a capital *S*). Chapter I., under the title of 'Spots on the Sun,' treats of the photosphere, and contains reproductions of those beautiful drawings by the author which we have already mentioned. The second chapter, treating of the chromosphere and corona, naturally draws largely upon government eclipse-reports for its illustrations. While many of the latter cannot lay claim to much artistic excellence, they are useful as illustrating very forcibly the difficulties attending the ordinary attempts to sketch the corona during the two or three minutes of a total eclipse, and the need that photography should supplant most of these except for the telescopic detail of the inner corona, which is too fine for the photographic plate, and for the extreme outer limits, for which the eye is much more sensitive. The interesting drawings of hydrogen-clouds and outbursts above the sun's photosphere are naturally nearly all from the works of Young and Tacchini, who have done so much in this field. Right here, in connection with all the illustrations of the book, we would heartily commend the pains taken to indicate the original author or source of every illustration used, either directly under it or in the text close by. This is a matter in which some careless or unscrupulous authors and editors need a sharp lesson.

Chapters III. and IV. are devoted to the sun's energy, and are the most interesting and instructive in the book. Space will not here allow us to note the exceeding number of interesting features dealt with, and we imagine that the author must have felt overwhelmed in trying to deal at all fully, even in forty-seven pages, with the wealth of important phenomena resulting from the outflow of solar energy. We cannot refrain, however, from noting the author's striking experiment of comparing solar radiation directly with the 'pour' of molten steel from a Bessemer 'converter,' — our hottest known source of artificial radiations on a large scale. The result showed that the solar surface, even after being dimmed by absorption in its own and the terrestrial atmospheres, gave out, foot for foot, at least eighty-seven times as much heat as the surface of molten steel, and was more than five thousand times as bright.

In speaking of the exhaustion of the coal-fields, our source of power, the author gives a striking picture of the fair green England of three hundred years ago as compared with its present smoky skies and soot-blackened surface, where the whole island throbs with the coal-driven engine, and the waters are churned by the swift steamer; and then, in the *rôle* of prophet, he unfolds the future of a few hundred years, when almost certainly the 'all-beholding sun' will send his beams "through rents in the ivy-grown walls of deserted factories, upon silent engines brown with rust, while the mill-hand has gone to other lands, the rivers are clean again, the harbors show only white sails, and England's 'black country' is green once more! To America, too, such a time may come, though at a greatly longer distance." And the fourth chapter closes with the following striking paragraph: —

"Future ages may see the seat of empire transferred to regions of the earth now barren and desolated under intense solar heat, — countries which, for that very cause, will not improbably become the seat of mechanical and thence of political power. Whoever finds the way to make industrially useful the vast sun-power now wasted on the deserts of North Africa or the shores of the Red Sea will effect a greater change in men's affairs than any conqueror in history has done; for he will once more people those waste places with the life that swarmed there in the best days of Carthage and of old Egypt, but under another civilization, where man no longer shall worship the sun as a god, but shall have learned to make it his servant."

The four remaining chapters are devoted to the planets and the moon, meteors, comets, and the stars. All equally interesting with the opening chapters, they deserve equal mention, but space forbids. Suffice it to say that they bring our information of new discoveries in these interesting fields up to date; some beautiful reproductions of the photographs of stellar spectra, taken at the Harvard College Observatory, being among the latest important additions to our knowledge of stellar constitution.

In conclusion, we hope that this excellent work of Professor Langley may go far towards its avowed object in arousing an interest in the new, not *versus*, but to an equal degree of importance with, the old astronomy. There can be no question that it is of as much importance to mankind to-day to know *what* the heavenly bodies are, as *where* they are; and the endowments to obtain men and apparatus (the former more scarce, and the latter more complicated and perhaps expensive) with which to answer the first question should be forthcoming. In the report, some years ago, of the National Academy of Sciences, upon the importance of moving the National Observatory to a new site, the establishment of a physical observatory under government auspices was recommended. This is directly in the line of the purpose of this book, and we trust that the latter may be one of the active factors in bringing into being, under government auspices, an observatory wherein the spectroscope, bolometer and galvanometer, polariscope, and photometer, with the rapid photographic plate as the adjunct of all, may stand on an equally important footing with the meridian-circle and the equatorial with only filar-micrometer attached.

NOTES AND NEWS.

THE latest results of the work of Prof. Josiah P. Cooke and Mr. T. W. Richards give as the atomic weight of oxygen, 15.869 ± 0.0017. This is from a paper presented at the American Academy of Arts and Sciences March 14.

— Hartleben's great atlas, 'Die Erde in Karten und Bildern,' is now well advanced. So far, twenty numbers have been issued. The maps are good lithographs, clearly drawn, well lettered, and not overcrowded with names. They serve admirably the purpose of the general reader. The accompanying text is profusely illustrated, and contains numerous views, costumes, etc. The physical geography is now complete, and is followed by a succinct geography of Europe. The price of the whole atlas is only $14.75.

— In *Science* of March 9, p. 121, 1st column, 29th line from bottom, for '90 mm.' read '65 mm.'

— In *Science* of Feb. 24, p. 96, 1st column, last line, for '108' read '118.'

LETTERS TO THE EDITOR.

Unusual Dermal Ossifications.

IN examining the collection of *Testudinata* in the Yale College Museum, I found in specimens of *Testudo Leithii*, Günth., dermal ossifications, which, so far as I am aware, have never been described.

Each fore-limb of this small tortoise is furnished with a well-ossified shield, which covers the anterior and inner part of the limb. This shield is composed of suturally united ossicles, covered by scales, and corresponding in number to the large scales on the fore-arm. Each ossicle is smooth on the inner side, and elevated into an eccentric tubercle on the outer side.

This condition seems important for the explanation of the origin of the carapace and plastron of the *Testudinata*, and supports my view on this point published elsewhere (*Zool. Anzeiger*, Nov. 22, 1886).

There can be no doubt that this peculiar shield of the fore-foot originally consisted of small, free ossicles. Probably different stages of this condition will be found, if these parts are carefully examined in the *Testudinidæ*.

The elemental form of the carapace was, there seems to be little doubt, exactly the same. There appeared at first distinct ossicles in the skin. With further development in this direction, these ossifications touched each other, forming a closed shield, the single elements of which were connected by suture.

As soon as this shield became connected with the endoskeleton. it found a support, many of the sutures disappeared, and the elements of the shield were disposed according to the arrangement of the endoskeleton.

In the above way the costal plates were developed. The ossicles, finding a support on the ribs, co-ossified with them and with each other.

The plastron has developed in the same way. The basis of the plastron probably consisted of dermal ossifications, generally called 'abdominal ribs.' By the increase of these dermal ossifications, the 'abdominal ribs,' the clavicles, and interclavicle were absorbed, forming a solid shield, in which the clavicles and interclavicle were transformed into epiplastron and endoplastron.

The oldest condition of the plastron of the *Testudinata*, therefore, was solid, and not pierced by fontanelles.

The oldest known representative of the *Testudinata*, *Proganochelys* (G. BAUR, 'Ueber den Ursprung der Extremitäten der Ichthyopterygia,' in *Bericht über die xx. Vers. des Oberrhein. Geol. Vereins*, Stuttgart, 1887, pp. 17, 18), from the triassic of Württemberg, confirms this opinion.

Embryology has nothing to say in this regard. The whole plastron (with exception, perhaps, of the epiplastron) is of dermal origin, and has nothing to do with the endoskeleton; but the ontogenesis of the exoskeleton is of no value for phylogenesis.

There are many authors (especially Cope and Dollo) who think that the representatives of the *Dermochelydidæ* (*Sphargididæ*), *Dermochelys* de Bl. and *Psephophorus* v. Meyer, are original forms; and Cope has created a peculiar group, '*Athecæ*,' for these and some allied genera (*Protostega*, Cope; *Protosphargis*, Cap.).

I cannot agree with this opinion, but consider these forms as the most specialized of the sea-turtles.

One group has developed from a form of *Testudinata* with well-developed carapace and plastron, by dissolution of their elements, into single ossicles, connected by suture (*Dermochelys*, *Psephophorus*). The other group has developed from a form of *Testudinata* by rudimentation of the costal plates (*Protostega*, *Protosphargis*).

The enormous *Chelonia Hoffmanni*, Gray, which has the costal plates very little developed, and the marginals very slender, shows characters between the *Cheloniidæ* and *Protostegidæ*, especially *Protosphargis*, and must rank as a different genus, which I propose to call '*Allopleuron*' (the generic characters are, costal plates, even in the adult, very little developed, covering only one-half of the rib; marginals very slender).

There have never been found mosaic-like dermal ossifications, neither in *Protostega* nor in *Protosphargis*. The plates considered by Professor Cope as probably belonging to the carapace belong to the plastron. The marginals have not disappeared, as in the *Dermochelydidæ*, but are present; those of *Protosphargis*, described by Capellini as probably phalangeal bones, resemble very much these elements in *Allopleuron*.

Sea-turtles have probably been developed at different times and in different localities, in the same way as the gigantic tortoises. The species of the Galapagos Islands are not directly related to those of the islands round Madagascar. Both have originated from two different stocks, — the first from some form of the American continent, the second from some one of African type.

G. BAUR.

New Haven, Conn., March 4.

End of the Swindler.

IT will give undoubted satisfaction to his many victims to learn that the 'swindling geologist,' whose depredations have been so frequently noted in your columns, has been lately convicted of stealing a number of microscopic objectives from the University of Cincinnati, and sentenced to spend five years at hard labor in the Ohio Penitentiary. He was sentenced under the name of O. L. Syrski, but admitted having pursued his calling under a variety of *aliases*, such as Taggart, Vasile, Ellison, Cameron, Douglas, Strong, Lee, Arundal, and Lesquereux. A valuable microscopic objective, found in his possession, awaits identification by the owner.

CHAS. H. GILBERT.

Cincinnati, March 9.

A Critique of Psychophysic Methods.

I READ with care the comment by Dr. Boas upon my article in the *American Journal of Psychology*, and carry away from it the impression that there is less difference of opinion between us than Dr. Boas supposes. The question is not one of fact, but of interpretation. We all admit that there is a psychophysic fact for which the word 'threshold' is a good name; but the important question is, How shall we theoretically understand the conception, and what place shall we allow it in the development of an experimental psychology? Fechner makes it rank as by all means the most important factor in psychophysics, and is willing to sacrifice Weber's law before yielding the supreme and fundamental fact of the threshold. He is led to this view by the method of the 'just observable difference,' and by the neglect of the other two methods. This entire structure I regard as reared upon an illogical basis, and a psychophysics based upon the mathematical methods as very different and much sounder than the other. The threshold as a practical, empirical fact, I not only fully admit, but even suggest methods of further developing its utility; but its theoretical importance with reference to the establishment of a psychophysic law I regard as almost *nil*, its true importance lying in another direction. This, I trust, defines my position clearly. A single illustration may not be out of place. Dr. Boas says that a balance has a threshold, and I accept the comparison. This threshold is something to be eliminated, and that balance is the finest that has the least of this characteristic. The theoretical balance upon which mechanics works out its principles has no threshold. But apart from this, I think the physicist will agree with me that it leads to more useful and scientific conceptions to regard every particle that is placed upon the pan of the balance as producing an effect alike in kind, and differing only in degree from that produced by a mass sufficient to turn the balance. There is no point where a new factor enters, and the turning of the balance is a merely empirical fact. Returning to the psychophysical methods, I should state the case thus: it is generally admitted that the basis of the method of the "right and wrong cases," as of the "average error," ultimately rests upon the fact that the probabilities of my making errors of various degrees follow the path traced by the probability curve. This is the fundamental fact of the entire science of psychophysics. Now, this curve is a *continuous* one, and has no break in it, no point characterized by any special peculiarity, no threshold in any true sense.

A word as to my misrepresenting the views of my opponents. The important point is, not what the upholders really do say, but what logically follows from the position they take. If they do not say what I attribute to them, it is because they are inconsistent; and I have guarded myself against this misunderstanding by at times stating, and elsewhere unmistakably implying, that I was dealing with the logical consequences of the threshold theory, and not with that particular portion of it that its adherents happened to employ.

The second point in Dr. Boas's criticism is a real difference of opinion between us. He thinks "doubtful" answers should be admitted in experimentation: I most emphatically object to them. In my paper I regarded the objections to allowing such answers as so necessarily following from the theory of the "right and wrong cases" method, that a full statement of the reasons was superfluous. Any one of half a dozen reasons is enough to show the impropriety of the "doubtful" answers. For instance: it is admitted that the methods should be as comparable, one with the other, as possible. Now, the method of the "average error" depending upon the same principle as that of the "right and wrong cases," allows no doubtful answers. Again: there is no reason for singling out "doubtful" answers as any thing peculiar. Why not make a special rubric of unusually confident answers? And if we do, as Dr. Boas suggests, make a threshold where doubtful answers no longer occur, that threshold will vary so much in different individuals, etc., that it will invalidate a large share of the results. And what shall I say when some one else proposes a threshold for another degree of confidence, say, the point where one is sufficiently sure of the correctness of one's answer to risk money upon it, and so on, *ad infinitum?* If you mean that this subjective feeling is worth taking account of, I fully concord, and will welcome the skilful observation of this feeling as an important contribution to psychophysics.

JOSEPH JASTROW.

Baltimore, March 12.

On the Sense of Taste.[1]

AT the Philadelphia meeting of the American Association we presented a paper upon the 'Delicacy of the Special Senses,' — a topic upon which we have since continued our investigations from time to time.[2]

The method pursued in the following experiments was as follows: —

Solutions of known strength were made of the substances to be tasted; then, by successive dilutions, several series of solutions were made from these, each one in the series being of one-half the strength of the preceding one. The bottles containing these solutions, and several bottles of water, were placed without regard to order, and the person to be experimented upon was requested to separate them into their proper groups by tasting them. In each series the last solution was so dilute as to be beyond recognition. All unrecognized solutions were classified as water.

We chose for our tests the following typical substances. The strength of the initial solution of each is given below.

1. (Bitter) quinine, one part in 10,000 parts of water.
2. (Sweet) cane-sugar, one part in 10 parts of water.
3. (Acid) sulphuric acid, one part in 100 parts of water.
4. (Alkaline) sodium bicarbonate, one part in ten parts of water.
5. (Saline) sodium chloride, one part in 100 parts of water.

The attempt was made to include other substances, as aromatics, in the test; but it was soon found that the odor betrayed their presence without the aid of the sense of taste.

Other investigators have added astringents as a sixth class, but these substances are so often recognizable by odor, color, or some special taste not purely astringent, that it was thought best not to include them.

Tests by the method above described were made upon 128 persons; 82 being male, and 46 female observers.

The following table shows the amount of each substance which could be detected by the average observer: —

Substances.	Male Observers detected.	Female Observers detected.
Quinine . . .	1 part in 392,000	1 part in 456,000
Sugar . . .	" " 199	" " 204
Acid	" " 2,080	" " 3,280
Soda	" " 98	" " 126
Salt	" " 2,240	" " 1,980

From the above results the following conclusions may be drawn: —

1. The sense of taste is vastly more delicate for bitter substances than for any others. It is possible to detect quinine in a solution that is only $\frac{1}{2000}$ the strength of a sugar solution, and we have previously shown (*loc. cit.*) that quinine is only $\frac{1}{10}$ as bitter as strichnine.

2. The order of delicacy is, bitter, acid, salt, sugar, and alkali.

3. The sense of taste appears to be more delicate in women than in men. This is true in the case of all the substances excepting salt. As we had found a similar difference in favor of female observers in an earlier and independent set of experiments, which agreed in every essential particular with the results of the present test, we do not regard it as an accidental difference, or as likely to disappear in more extended investigations.

Marked differences in the delicacy of the sense of taste of different individuals were met with in the course of these experiments.

[1] Paper read at the New York meeting of the American Association for the Advancement of Science, August, 1887.

[2] See Relative Bitterness of Different Bitter Substances, by E. H. S. Bailey and E. C. Franklin, in *Proceedings of the Kansas Academy of Sciences*, 1885; Relative Sweetness of Sugars, by E. H. S. Bailey, in *Report of Kansas Board of Agriculture*, 1884; The Sense of Smell, by E. L. Nichols and E. H. S. Bailey, in *Nature*, XXXV. p. 74.

There were persons who could place in the proper class, solutions containing one part of quinine in 500,000, and other substances in correspondingly high dilution, while some failed to detect solutions of more than three times the above strength. In how far this was due to education, we are unable to say. Among the men examined were many who have been accustomed to handling and recognizing drugs and medicines, and yet even these were frequently surpassed by female observers who had no such training.

In some previous experiments upon the sense of smell, of which an account appeared in *Nature* (*loc. cit.*), we noted almost as marked superiority on the part of male observers.

In a few cases, the ability to detect a dilute sweet was accompanied by a lack of ability to detect dilute bitters. This peculiarity was, however, far from being a general one.

As quinine is so largely used as a medicine, especially in the Western States, it was thought that its habitual use might dull the sense of taste for this particular substance. Among the observers subjected to our experiments, the use or disuse of quinine seemed to have had no especial influence.

The experiments just described suggested several interesting questions upon which we were unable to enter. How many, for instance, of these substances, taken of equal delicacy-strength, could be detected together in a mixture, in what order would they be detected, and by what portion of the tongue or organs of taste? Would all observers recognize them in the same order as to time? What would be the influence of the temperature of a solution tasted, upon the delicacy of the sense of taste?

As to the degree of accuracy with which our results give the average delicacy of the human sense of taste for the substances in question, we are led to believe from their substantial agreement with determinations based upon the previous set of experiments already alluded to, alike in the matter of absolute delicacy, of relative delicacy, for the various substances used, and of relative sensitiveness of male and female observers, that they are but slightly influenced by individual idiosyncrasies, and may be regarded as fairly representative.

E. H. S. BAILEY.
E. L. NICHOLS.

On New Facts relating to Eozoon Canadense.

IN the February number of the *Geological Magazine* there is an interesting article by Sir J. W. Dawson, 'On New Facts relating to Eozoon Canadense.' In paragraph 9, 'Continuity and Character of the Containing Deposits,' there are some remarks respecting the stratigraphy of the Archæan or older crystalline rocks of Canada upon which I wish to make a few comments.

The author does not indicate what are, in his opinion, "the extravagant statements respecting the older crystalline rocks now being made," nor by whom they have been made. Neither does he state what portion of the Laurentian system is referred to under the term 'Middle Laurentian,' nor where he has recently examined it. I am not aware that Sir W. Logan ever used the term 'Middle Laurentian.' As regards the 'continuity of the great limestones' over certain areas, and their intimate association and interbedding with the gneisses, both orthite and anorthite, it has, so far as I know, never been questioned. In some cases, however, the limestones are very irregular, and occur in longish, more or less lenticular bands interleaved with the gneisses, often in such a manner as to suggest an origin posterior to that of the gneisses, or, rather, to that of the strata from which they have been produced. It is, I think, more than probable that original sedimentation of calcareous matter, and subsequent segregation, have both operated in producing the phenomena now observed in connection with these great limestone belts, the latter somewhat analogous to that which has produced the great 'quartz belts' in the Nova Scotia goldfields.

I must entirely dissent from the views expressed by the author in correlating any of the so-called Upper Laurentian anorthosites of the vicinity of St. Jerome, or elsewhere, with the Huronian rocks west of Lake Superior. The massive anorthosites, as I have elsewhere stated, are clearly intrusive, and the surrounding gneisses and limestones do not pass beneath them; and there are no grounds whatever for regarding them as an unconformable Upper Laurentian series. On p. 4, 'Report of Progress, Geological Survey of Canada' 1879–80,' I wrote, "If the foregoing determinations by Mr. Vennor, which are given in his own words, are correct, they seem very conclusively to prove, what I have already stated to be my opinion, that the labradorite or Norian rocks of Hunt do not constitute an Upper Laurentian formation, but occur in part as unstratified intrusive masses, and in part as interstratifications with the orthoclase gneisses, quartzites, and limestones of the Laurentian system." It is satisfactory to find that Sir William Dawson is now disposed to admit that the "great masses of labradorite may be intrusive;" but when these are eliminated, nothing remains of the Upper Laurentian as defined in any of these areas, from the Moisie River to St. Jerome; and unless the interstratified anorthite gneisses are made Upper Laurentian, the term, so far as the Norian or labradorite rocks of the areas named are concerned, must be abandoned, and I would reiterate what I wrote in 1884 ('Descriptive Sketch of the Physical Geography and Geology of Canada, 1884'):—

"As regards the so-called Norian or Upper Laurentian formation, I have no hesitation in asserting that it has as such no existence in Canada, its theoretical birthplace. Wherever these Norian rocks have been observed, they are either intimately and conformably associated with the ordinary orthoclase and pyroxene gneisses, or they occur as intrusive masses when they present no gneissoid or bedded structure. They clearly cut the surrounding gneiss, and are probably due to volcanic or other igneous agency in the Laurentian age."

Considerable further investigation since the above was written has entirely supported the view then expressed.

ALFRED R. C. SELWYN.

Ottawa, March 13.

Queries.

30. POISONOUS JELLY-FISH. — Last summer, while bathing on the Maine coast, I had what was to me a novel and not very enjoyable experience. While swimming I happened by accident to kick some sort of an animal. For an instant the feeling that passed over my feet was like a slight electric shock. Of course, I turned to see what the animal was, and, from the glimpse which I had, I should call it a red jelly-fish. For three or four hours after, my feet were slightly inflamed and very painful, the feeling being like that caused by a burn. Afterwards I learned that a certain kind of jelly-fish was said by fishermen thereabouts to be poisonous. Can you tell me through your columns about this animal, what it is, and how it stings, shocks, or poisons? What is the remedy for its poisons? Zoö.

Boston, Mass., Feb. 29.

Answers.

30. POISONOUS JELLY-FISH. — The above doubtless refers to the effects of our common large red jelly-fish (*Cyanea arctica*). Many jelly-fishes have the power of stinging soft-skinned animals, and in this way ordinarily kill and secure their prey; but there are only a few species that have nettling threads powerful enough or long enough to sting the human skin. On our New England coast the only ones that are able to sting thus are the *Cyanea*, referred to above, and the Portuguese man-of-war (*Physalia*); but the latter is not common, and is rarely, if ever, found on the shore north of Cape Cod. The *Cyanea* stings many persons very severely, especially if the tentacles come in contact with a tender part of the skin, as the face, lips, eyes, or between the fingers, and of course on any part of the body that is ordinarily covered; but in my experience they will not sting the palms of the hand. The sensation is much like that of the sting of a nettle ordinarily; but in some cases, or with some persons particularly sensitive to the poison, it results in numbness, swellings, and subsequent eruptions, and even ulcerations. The *Physalia* stings much more severely than *Cyanea*, and is able to cause temporary paralysis of the arm or leg; and in some experiments it has been found to act in such a way as to affect the heart: perhaps in a severe case it might even cause paralysis of the heart. The nature of the poison is unknown, but it must be very powerful, for the quantity is minute. A. E. V.

New Haven, March 10.